START

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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 166768

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. Date
Supplemental [ ] Direct Revision [X] Change ECN [ ] Temporary [ ] Standby [ ] Supersedure [ ] Cancel/Void [ ]	J. M. AYRES /100 Area RI/H6-02/E-3918	01/18/93
	5. Project Title/No./Work Order No. DOW for Vadose Drilling in 100-FR-1, WHC-SD-EN-AP-091, Rev 1, P711A	6. Bldg./Sys./Fac. No. 740 Stevens
		7. Impact Level 3Q
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-EN-AP-091, Rev 0	9. Related ECN No(s). NA
		10. Related PO No.

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[ ] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N\A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

Document Revised per Regulator Comments

13a. Justification (mark one)							
Criteria Change	[ ]	Design Improvement	[ ]	Environmental	[X]		
As-Found	[X]	Facilitate Const.	[ ]	Const. Error/Omission	[ ]	Design Error/Omission	[ ]

13b. Justification Details

Comment Incorporation Mandatory

14. Distribution (include name, MSIN, and no. of copies)

JM AYRES	H6-02
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DATE JAN 19 1993

Station # 12

A-7900-013-2 (06/92) GEF095
Engineering Change Notice

A-7900-013-1 (11/88)

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 166768

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]		[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer J. M. Ayres	1/19/93	PE	
Cog. Mgr. R. P. Henckel	1/19/93	QA	
QA G. S. Corrigan	1-19-93	Safety	
Safety		Design	
Security		Environ.	
Environ.		Other	
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations		DEPARTMENT OF ENERGY	
Restoration & Remediation		Signature or Letter No.	
Operations & Support Services			
IRM		ADDITIONAL	
Other			

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SUPPORTING DOCUMENT

1. Total Pages 18

2. Title	3. Number	4. Rev No.
Description of Work for Vadose Drilling in the 100-FR-1 Operable Unit	WHC-SD-EN-AP-091	1

5. Key Words

BOREHOLES, EXCAVATION, TEST PITS

APPROVED FOR PUBLIC RELEASE

6. Author

Name: J. M. AYRES

Signature 11/9/93

Organization/Charge Code 81310/P711A

7. Abstract 1-19-93 D. Soles

AYRES, J. M. 1993, *Description of Work for Vadose Drilling in the 100-FR-1 Operable Unit*, WHC-SD-EN-AP-091, Rev 1, Westinghouse Hanford Company, Richland, Washington

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9. Impact Level 3Q

10. RELEASE STAMP

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RECORD OF REVISION	(1) Document Number WHC-SD-EN-AP-091, Rev 1	Page 1

(2) Title
Description of Work for Vadose Drilling in the 100-FR-1 Operable Unit

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initial release, EDT 159841		
1 RS	ECN 166768, Incorporate regulator comments to Rev 0	J. M. Ayres 11/19/93	R. P. Henckel

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FIGURES:

TABLES:

1.0 SCOPE OF WORK

This description of work (DOW) details the field activities associated with cable-tool drilling of six vadose boreholes and backhoe excavation of four test pits in the 100-FR-1 Operable Unit (Task 5) and will serve as a field guide for those performing the work. It should be used in conjunction with the *Remedial Investigation/Feasibility Study Work Plan for the 100-FR-1 Operable Unit, Hanford Site, Richland, Washington* (DOE-RL 1992) for general investigation strategy and with *Environmental Investigations and Site Characterization Manual* (WHC 1988a) for specific procedures. Test pit and borehole locations are shown on Figures 1 through 4.

2.0 GENERAL REQUIREMENTS

2.1 HEALTH AND SAFETY

All personnel working to this description of work will have completed the 40-Hour Hazardous Waste Site Worker Training Program and will perform all work in accordance with the following:

- WHC-EP-0383, *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990)
- WHC-CM-4-10, *Radiation Protection* (WHC 1988b)
- WHC-CM-4-11, *ALARA Program* (WHC 1988c)
- WHC-CM-4-3, *Industrial Safety Manual*, Vol. 1 through 3 (WHC 1987)
- WHC-CM-7-5, *Environmental Compliance Manual* (WHC 1988d)
- WHC-SD-EN-SAD-002, Rev 0, *100 Area Low Hazard Characterization Activities Safety Assessment* (Taylor 1991)
- Site-specific health and safety plan/job safety analysis.

2.2 PREREQUISITES

The requirements and procedures applicable to the 100-FR-1 operable unit field activities are specified in the *Environmental Investigations and Site Characterization Manual* (WHC 1988a). The environmental investigation instructions (EII) that are applicable include:

EII 1.1	Hazardous Waste Site Entrance Requirements
EII 1.5	Field Logbooks
EII 1.13	Readiness Review
EII 2.1	Preparation of Hazardous Waste Operations Permit

Figure 1. Location of Test Pits 116-F-1B, 116-F-1C

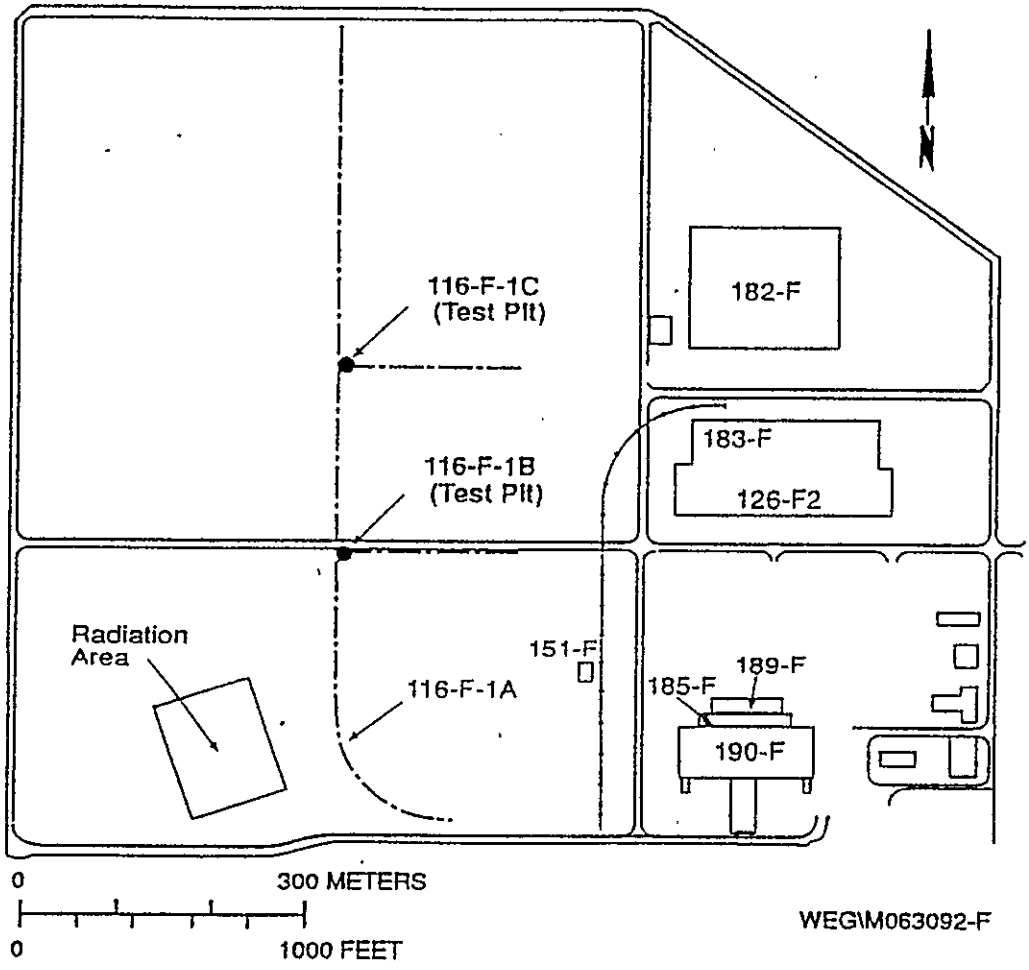


Figure 2. Location of Boreholes 116-F-1A

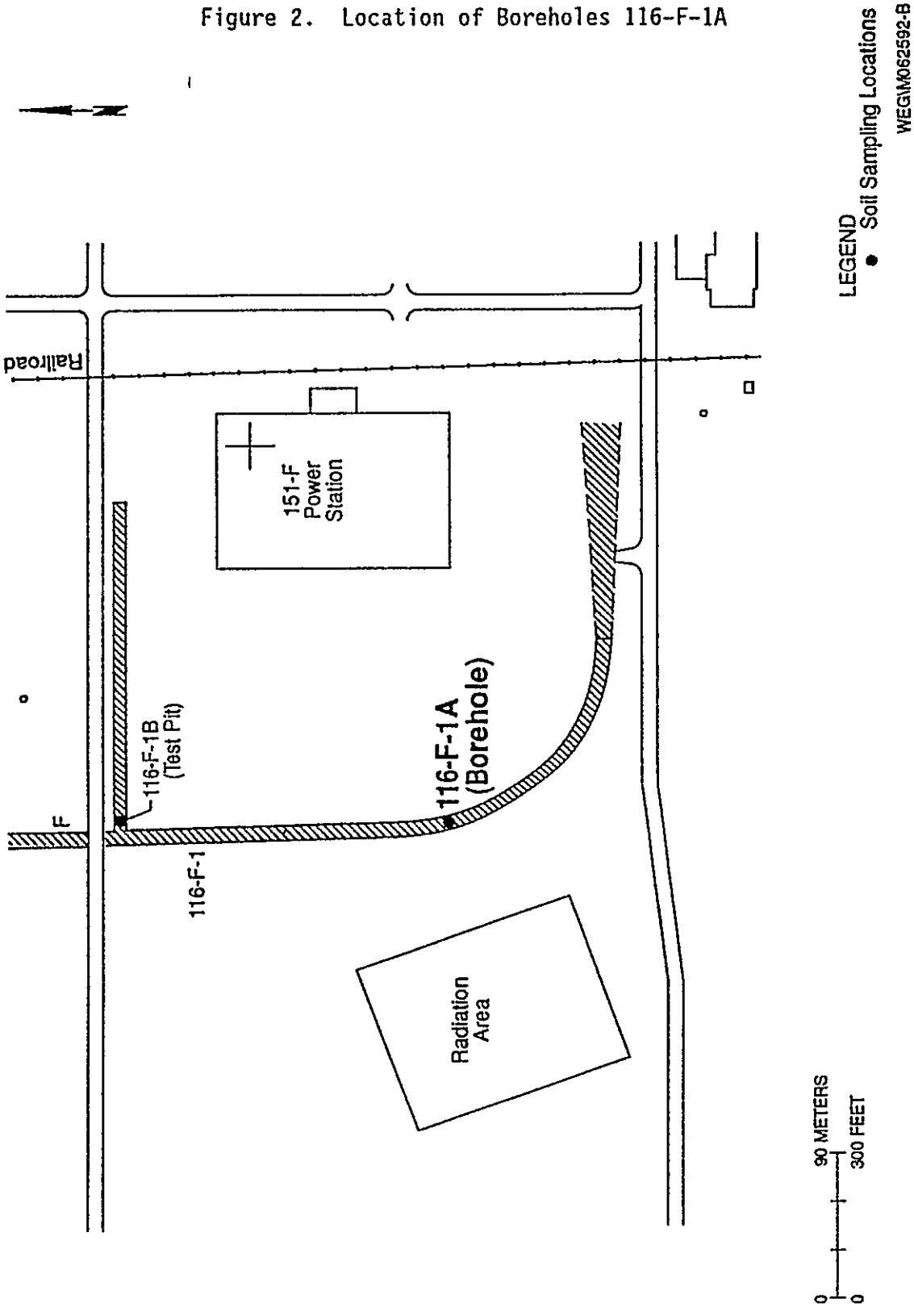


Figure 3. Location of Holes 116-F-3, 116-F-4, 116-F-6, and 108-F (Hand Sample)

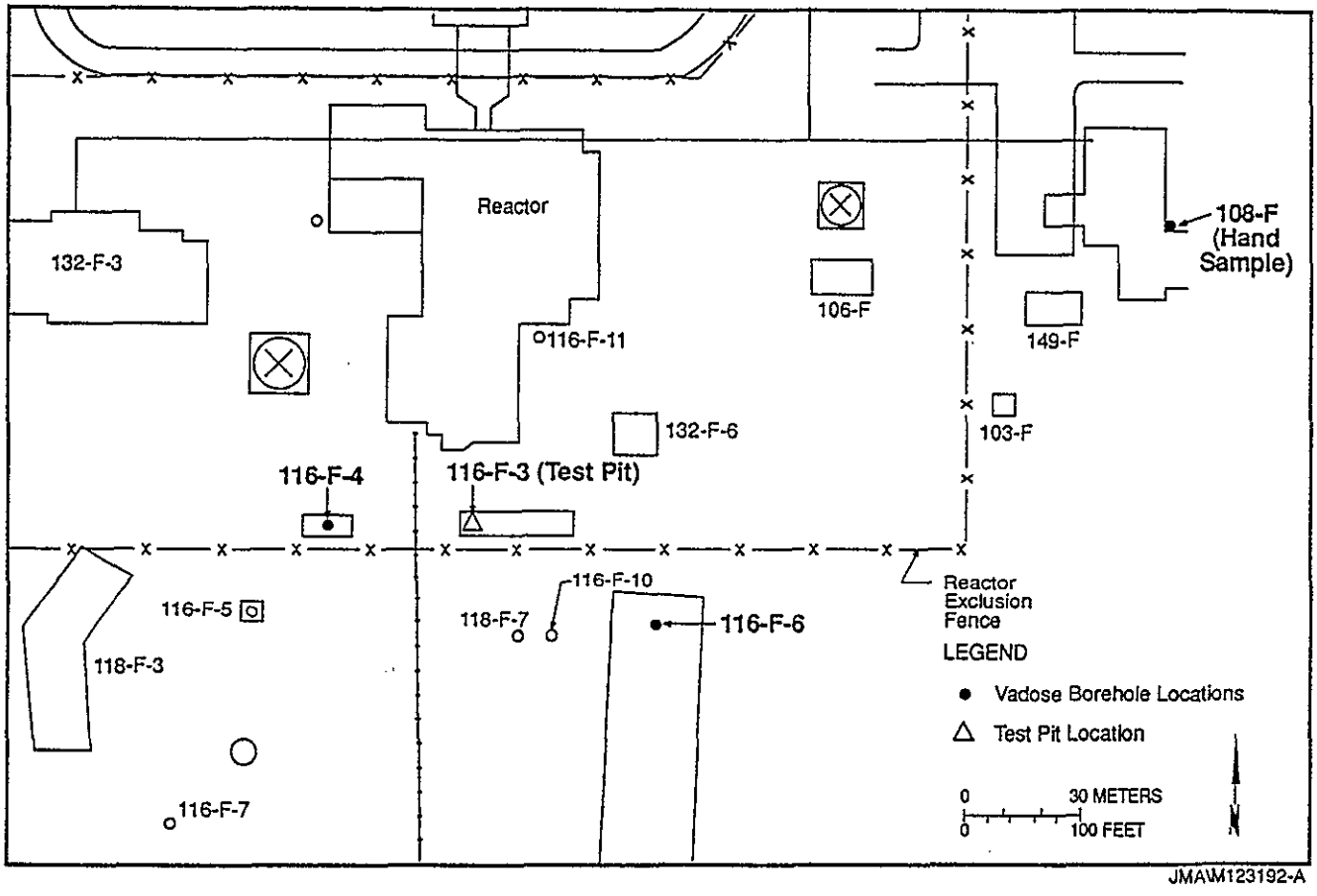
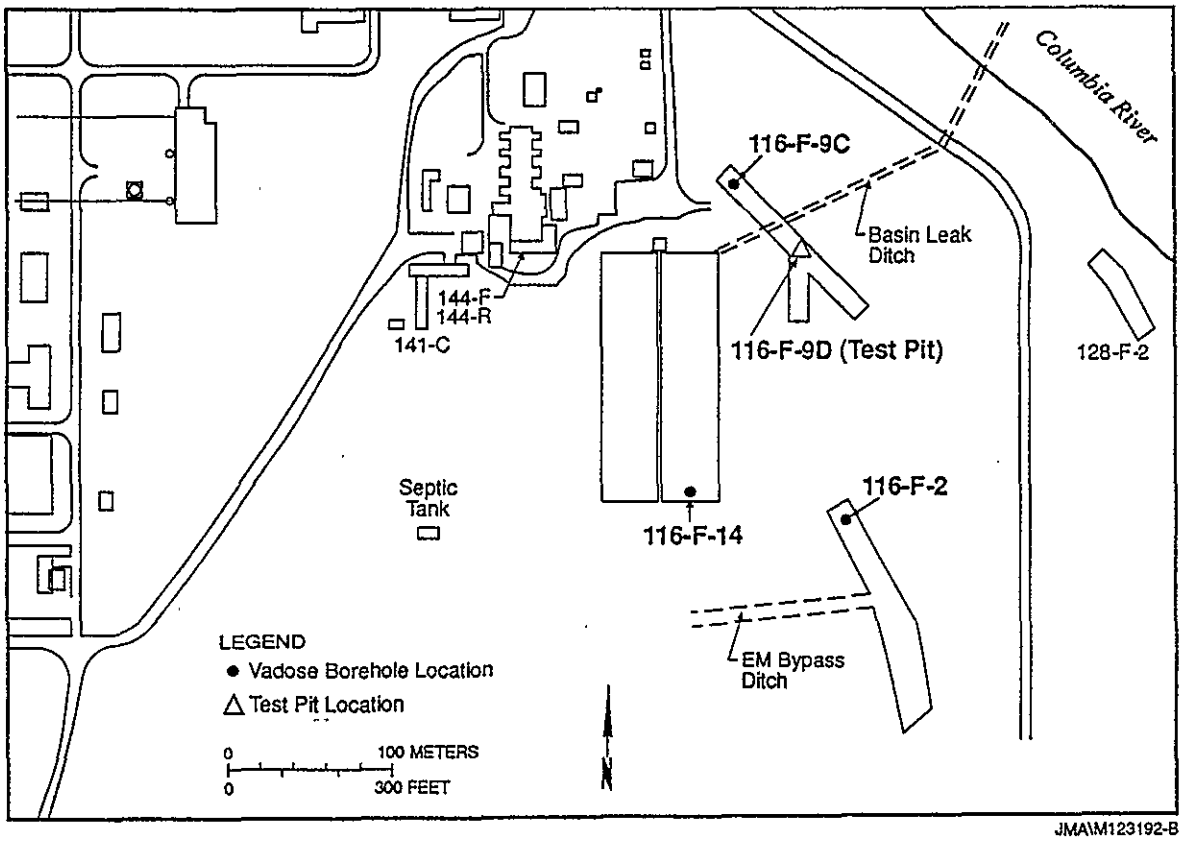


Figure 4. Location of Holes 116-F-9C, 116-F-9D, 116-F-2, and 116-F-14



EII 3.2	Health and Safety Monitoring Instruments
EII 3.4	Field Screening
EII 4.3	Control of CERCLA and Other Past-Practice Investigation Derived Waste
EII 5.1	Chain of Custody
EII 5.2	Soil and Sediment Sampling
App. B	Split-Spoon Sampling Method
App. E	Surface Sampling Method
EII 5.4	Field Decontamination of Drilling, Well Development, and Sampling Equipment
EII 5.7A	Hanford Geotechnical Sample Library Control
EII 5.10	Obtaining Sample Identification Numbers and Accessing HEIS Data
EII 5.11	Sample Packaging and Shipping
EII 6.1	Activity Reports of Field Operations
EII 6.7	Resource Protection Well and Test Borehole Drilling
App. A	Drilling with a Cable-Tool Drill Rig
EII 9.1	Geologic Logging
EII 11.1	Geophysical Logging

Each item on the Drilling Planning Form (EII] 6.7, Resource Protection Well and Test Borehole Drilling [WHC 1988a]) or the checklist for tasks requiring no readiness review (EII 1.13, Environmental Engineering and Geotechnology Readiness Review [WHC 1988a]) will be signed and dated by the cognizant engineer or field team leader (FTL) prior to the start of work.

3.0 SAMPLING AND FIELD ACTIVITIES

3.1 SOIL SCREENING

3.1.1 Borehole

All samples and cuttings will be field screened for evidence of volatile organic compounds (VOC) and radionuclides. VOC will be screened by the field geologist using an organic vapor monitor (OVM) that will be used, maintained, and calibrated consistent with EII 3.2, Health and Safety Monitoring Instruments, and EII 3.4, Field Screening, Appendix B, (WHC 1988a). Radionuclide screening will be performed by the field geologist per EII 3.4, Field Screening, Appendix A, (WHC 1988a). The field geologist will record screening results in the borehole log.

The action level from radionuclide screening is twice background and, for VOC screening, 5 ppm above background. Prior to initiating drilling, a one-time instrument background reading will be recorded using the OVM, and radionuclide detection instrument at the background site (Figure 5). Figure 5 does not address vadose hole locations. OVM instrument background will be measured by taking readings at the work site by measuring ambient air for 1 minute. The field geologist will record the background levels in the borehole log prior to the start of drilling.

Chromium screening will take place only on the last sample interval using a portable hexavalent chromium test kit per EII 3.4, Field Screening, Appendix C, (WHC 1988a). The field geologist will record the screening results in the borehole log. The Chromium screening is for general information, thus no action level is required.

Boreholes will be abandoned per EII 6.7 (WHC 1988a).

3.1.2 Test Pit

All excavated material removed from the test pit will be field screened by the geologist, for evidence of VOC and radionuclides (DOE-RL 1991, Section 5.1.1.5.3). VOC will be screened using an OVM that will be used, maintained, and calibrated consistent with EII 3.2, Health and Safety Monitoring Instruments, and EII 3.4, Characterization Instruments, Appendix B, (WHC 1988a). Radionuclides will be screened per EII 3.4, Appendix A. Field screening results will be recorded in the logbook.

The action level for radionuclide screening will be twice background, and for VOC, 5 ppm above background. Prior to initiating test pit excavation, one-time background readings for the VOC and radionuclides will be taken and recorded in the logbook. The VOC background reading will be taken at the background site (Figure 5) with an OVM in accordance with EII 3.4 Appendix B. The radionuclide background reading, the type of instrument used, and the unit of measurement will be recorded in the logbook.

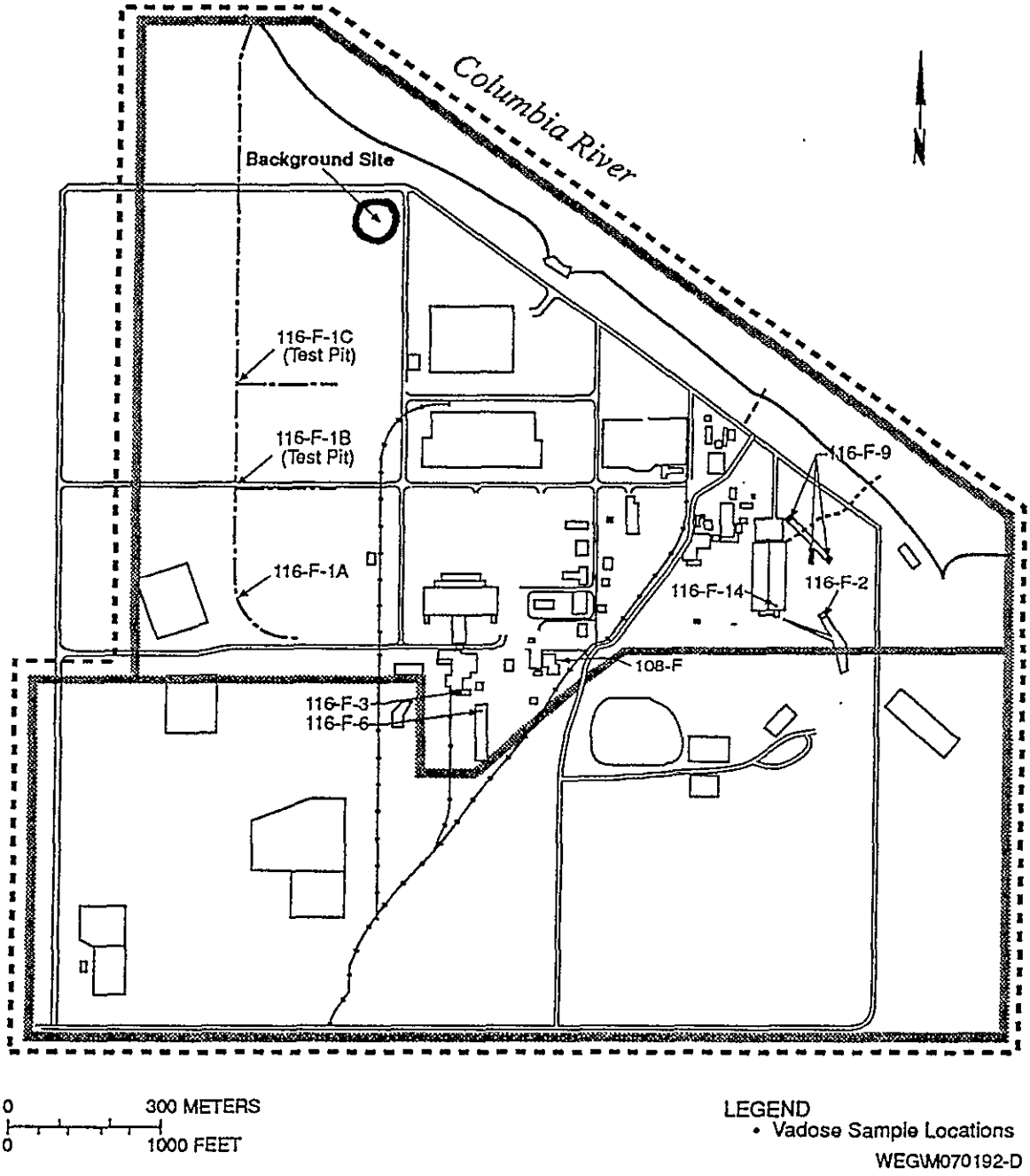
Chromium screening will take place only on the last sample interval using the portable hexavalent chromium test kit per EII 3.4, Field Screening, Appendix C, (WHC 1988a). There will be two chromium screenings at different locations within the last sampling interval. Hexavalent chromium screening results will be recorded in the logbook. The Chromium screening is for general information, thus no action level is required.

3.2 BOREHOLE GEOLOGIC SAMPLING

Geologic samples will be taken at 5-ft intervals and at major stratigraphic changes for the preparation of borehole logs (DOE-RL 1992, Section 5.1.1.5.2) and EII 9.1, Geologic Logging (WHC 1988a). The field geologist shall archive the nonradioactive geologic samples per EII 5.7A, Hanford Geotechnical Sample Library Control (WHC 1988a).

All waste generated as a result of the vadose investigaion activities will be handled according to EII 4.3, Control of CERCLA and Other Past-Practice Investigation Derived Waste.

Figure 5. Location of Background Site



3.3 ANALYTICAL SAMPLING

One analytical sample will be taken of the surface soil at each borehole or test pit location prior to commencement of drilling or excavating. These surface samples will be collected per EII 5.2, Soil and Sediment Sampling (WHC 1988a) and analyzed per Section 4.0 of this Description Of Work (DOW). Test pit 116-F-1C will be sampled to the water table regardless of screening. All other analytical sampling will be based on the following:

1. If drill cuttings or exposed material in the backhoe bucket fail (are greater than or equal to) the screening criteria, collect and analyze samples at that point and continue sampling at 5-ft intervals until two consecutive clean samples below the expected (observed) waste depth pass the screening criteria. Maximum sampling depth will be 5 ft below the water table.

2. If drill cuttings or exposed material in the backhoe bucket pass (are less than) the screening criteria. Continue Screening up to the expected waste depth. Collect and analyze one sample from the expected waste depth and continue sampling at 5-ft intervals until two consecutive samples pass the screening requirements. If any cuttings or exposed material fail the screening criteria, then proceed as in item 1 above.

3.3.1 Borehole

Analytical sampling will be conducted using a split-spoon sampler per the 100-FR-1 Operable Unit work plan (DOE-RL 1992, Section 5.1.1.5.2) and EII 5.2, Soil and Sediment Sampling (WHC 1988a). Soil cuttings will be continuously screened along the entire soil column per the criteria stated in Section 3.1 from the surface to the final depth.

Table 1. Borehole Expected Waste Depths.

Borehole	Expected waste depth (ft)	Depth to groundwater (ft)[b]
116-F-1A	10[a]	13
116-F-2	20[b]	35
116-F-4	20[a]	37
116-F-6	20[a]	36
116-F-9C	20[c]	50
116-F-14	24[c]	30

[a] from Dorian and Richards, 1978
[b] based on Hanford Site Waste Information Data System (WIDS)
[c] based on trench depth from WIDS

3.3.2 Test Pit

Analytical samples will be collected directly from the backhoe bucket using hand tools and standard soil sampling techniques per EII 5.2, Soil and Sediment Sampling (WHC 1988a). Excavated soil will be continuously screened

over the entire soil column per the criteria stated in Section 3.1 from the surface to the final depth. The bucket will be cleaned of visible dirt between test pit locations. A bucket of soil will be removed from the desired sampling interval and brought to the side of the test pit for sampling. Samples will be collected from soil in the middle of the bucket, away from the bucket sides.

Sample depths will be estimated using measured dimensions of the backhoe bucket and arm. Measurements may be marked on the bucket using soapstone or other noncontaminating marker. If a more precise method of measuring sample depths is used, it will be identified in the field logbook.

All waste generated as a result of test pit investigation activities will be handled as a special case as stated in EII 4.3, Control of CERCLA and other Past-Practice Investigation Derived Waste (WHC 1988a). At the direction of the field team leader, plastic or other covering may be placed on the ground adjacent to the excavation for the temporary stock-piling of excavated material. After all samples have been collected at a particular location, the excavation will be backfilled in approximately the reverse order, so that the first bucketful excavated is the last bucketful backfilled. Material will be compacted after replacement, to the extent possible, with the backhoe bucket.

The expected waste depths for the two test pits (116-F-1B and 116-F-1C) are from the surface to groundwater. Sampling will commence at the surface and continue every 5 feet to at least 13 feet. Continue sampling until screening results indicate clean as per Section 3.3. In both locations, the ground water is estimated to be at a depth of about 13 ft (Dorian and Richards, 1978).

The 108-F crib will be sampled at the surface and again at 5 feet below ground surface with a hand auger.

Table 2. Test Pit Expected Waste Depths.

TEST PIT	EXPECTED WASTE DEPTH (ft)	DEPTH TO GROUNDWATER (ft)
116-F-1B	0 - 13	13
116-F-1C	0 - 13	13
116-F-3	20	37
116-F-9D	20	50

3.4 SOIL SAMPLING (PHYSICAL PROPERTY)

Up to five samples for physical property analysis will be collected from the borehole at 116-F-14 Retention Basin (DOE-RL 1992, Section 5.1.1.5.2). Samples submitted for physical properties analysis must be below the detection limits of the instruments for both radionuclides and VOC. To achieve this, it may be necessary to drill beyond the screening cutoff point.

At intervals where both physical property and analytical sample collection are called for, analytical sampling takes priority if an inadequate sample volume is available.

A split-spoon sampler will be used in lieu of a carbide-tipped core barrel per the work plan for the 100-FR-1 Operable Unit (DOE-RL 1992, Section 5.1.1.5.2).

The field geologist must use professional judgement to select samples that are representative of the principle soil types that can be sampled with the split-spoon sampler. The basic criteria for the sample location is that the sample shall be collected at or below the expected waste depth as defined in Section 3.3. Two 6-in. sleeves will provide adequate sample volume. The field geologist will record the selected samples in the borehole log per EII 9.1, Geologic Logging (WHC 1988a).

The physical property samples will be measured for the following parameters using American Society for Testing and Materials (ASTM) methods (DOE-RL 1992, Section 5.1.1.5.4 and Attachment 1). Unsaturated hydraulic conductivity will be calculated, and the sample will be archived.

- Bulk density
- Particle size distribution (ASTM D422-63)
- Moisture content (ASTM D2216)
- Moisture retention (ASTM D2325-68, D3152-72)
- Saturated hydraulic conductivity (ASTM D2434-68)
- Unsaturated hydraulic conductivity at 10% moisture content after full saturation.

3.5 GEOPHYSICAL LOGGING

All boreholes will be logged using either a gross gamma or spectral gamma logging tool per the 100-FR-1 Operable Unit work plan (DOE-RL 1992, Section 5.1.1.5.2) and EII 11.1, Geophysical Logging (WHC 1988a). Spectral gamma logging is preferred. If the spectral gamma logging tool is not available, the gross gamma logging tool will be used. The FTL will annotate the reason for not using the spectral gamma logging tool in the Field Logbook (EII 1.5) No geophysical logging will be performed in the test pits.

4.0 ANALYSES

Samples collected for chemical analysis will be analyzed for the full suite of Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Contract Laboratory Program (CLP) target compound list (TCL) (EPA 1988) and target analyte list (TAL) (EPA 1989) constituents and certain specified ions and radionuclides. Estimated quantity of material needed for analyses are shown in Table 3. The laboratory will use existing Level IV CLP methods and methods approved under their contract for radiological analyses (Level V, Level III for anions). Sample custody will follow the procedures as specified in 100-FR-1 Operable Unit work plan (DOE-RL 1992, Appendix A, Section 5.0) and EII 5.1, Chain of Custody (WHC 1988a).

Table 3. List of Analytes.

Analyte	Method	Holding Time	Container/Volume
Generic			
ICP/AA metals	200.7 CLP-M[a]	6 mo	Glass, 250 mL
Mercury	245.1 CLP-M	28 d	
Cyanide	335.2 CLP-M	14 d	
Volatile organic	CLP[b]	14 d	Glass, 125 mL
Semivolatile organic	CLP[b]	7 d[c]	Amber glass, 1,000 mL
PCB/pesticides	CLP[b]	7 d[c]	
Anions/IC:			
fluorides	EPA 300[d]	28 d	
sulfates	EPA 300[d]		
nitrates, nitrites	EPA 353.2		
TMA			
Gross alpha	EA-82	6 mo	Glass/plastic, 1,000 mL
Gross beta	EA-82		
Gamma spec	RC-30		
Alpha spec			
Americium-241	EP-80, EP-90, EP-92, EP-93, EP-5		
Plutonium-239/240	EP-80, EP-81, EP-5		
Uranium-235/238	EP-70, EP-71, EP-5		
Carbon-14	EA-85, EA-85A		
Strontium-90	RC-306, RC-303, RC-309, RC-304		
Weston			
Gross alpha	PRO-032-302	6 mo	Glass/plastic, 1,000 mL
Gross beta	PRO-032-302		
Gamma spec	PRO-042-5		
Alpha spec			
Americium-241	PRO-062-109		
Plutonium-239/240	PRO-052-32		
Uranium-235/238	PRO-052-32		
Carbon-14	PRO-032-80		
Strontium-90	PRO-032-38, PRO-032-25		
222-S Laboratory			
Total activity	Prep: LA-548-111 Procedure: LA-508-121	6 mo	Plastic or glass small vial (at least 1 g)

AA = atomic absorption
IC = ion chromatography
ICP = inductively coupled plasma
SOP = standard operating procedure.

NOTE: There are no chemical preservation requirements.

[a]Modified for the Contract Laboratory Program.

[b]CLP methods, target detection limits, and minimum values for precision and accuracy shall be as specified in the statement of work for CLP services (EPA 1988, 1989).

[c]7 d to extraction; 40 d after.

[d]Modified (Lindahl 1984).

If full sample volume requirements cannot be met, the FTL or the sampling scientist will record the volume obtained and the reason(s) why the full sample volume requirements cannot be met in the logbook per EII 1.5, Field Logbooks (WHC 1988a) and the field samplers collect samples in the following order:

1. Radioisotopes
2. Semivolatiles/PCB/Pesticides/Anions
3. TAL
4. Total Activity.
5. Volatiles

5.0 QA/QC REQUIREMENTS

Internal QC samples shall be collected as specified in Appendix A, Quality Assurance Project Plan, (DOE-RL 1992) with the revisions as outlined below. The sampling shall be documented in the sampling logbook per EII 1.5, Field Logbooks (WHC 1988a).

1. Collect one duplicate per sampling session or every 20 samples, which ever is greater.
2. Collect split samples at the same frequency as duplicates.
3. Field blanks are not required.
4. Collect one sample each month from any source of water introduced into the hole during drilling. Only one sample is required for both groundwater and vadose borings. Analyze for the full suite of water parameters. (See Stankovich [1992] for parameters and volume requirements.)
5. Collect one trip blank for each batch of containers shipped to the sampling (site) facility and analyze for volatile organics only. The media shall be silica sand.
6. Collect equipment blanks at the same frequency as duplicates and analyze for constituents listed in Table 3. The media shall be silica sand.
7. Collect two background samples from the background site shown in Figure 5, and analyze for the constituents listed in Table 1. This requirement is for borehole samples only.

6.0 SCHEDULE

The following schedule is for drilling and sampling in the 100-FR-1 Operable Unit for 1993. This schedule is subject to change and the DOE-RL operable unit manager should be contacted for current status. An Agreement Activity Notification form will be issued at least 5 days prior to the start of field work.

Borehole location	Drilling dates
116-F-6	Late Jan. to mid Feb. 1993
116-F-2	Late Jan. to mid Feb. 1993
116-F-1A	Mid to late Feb. 1993
116-F-9C	Mid to late Feb. 1993
116-F-14	Early to mid March 1993
116-F-4	Early to mid March 1993

Test Pit Location	Excavation Date
116-F-1B	Late March 1993
116-F-1C	Late March 1993
116-F-3	Early April 1993
116-F-9D	Early April 1993
108-F (Hand Sample only)	As convenient

7.0 CHANGES TO DESCRIPTION OF WORK

Unforseeable major changes to this description of work, such as analyzing different parameters, using different analytical methods, or changing the sampling interval will be submitted using the Engineering Change Notice (ECN) form (forseeable changes will be submitted to the lead regulatory agency for approval or review prior to deviating from the DOW). Copies will be submitted to the lead regulatory agency and appropriate field personnel within 10 working days of the change.

8.0 REFERENCES

DOE-RL 1991, *Hanford Site Waste Information Data System*, data file accessed June 16, 1991, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL 1992, *Remedial Investigation/Feasibility Study Work Plan for the 100-FR-1 Operable Unit, Hanford Site, Richland, Washington*, DOE/RL-90-33, Rev. 0, U.S. Department of Energy, Richland Field Office, Richland, Washington.

Dorian, J.J. and V.R. Richards; (1978); *Radiological Characterization of the Retired 100 Areas*; UNI-946; United Nuclear Industries, Richland, WA.

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